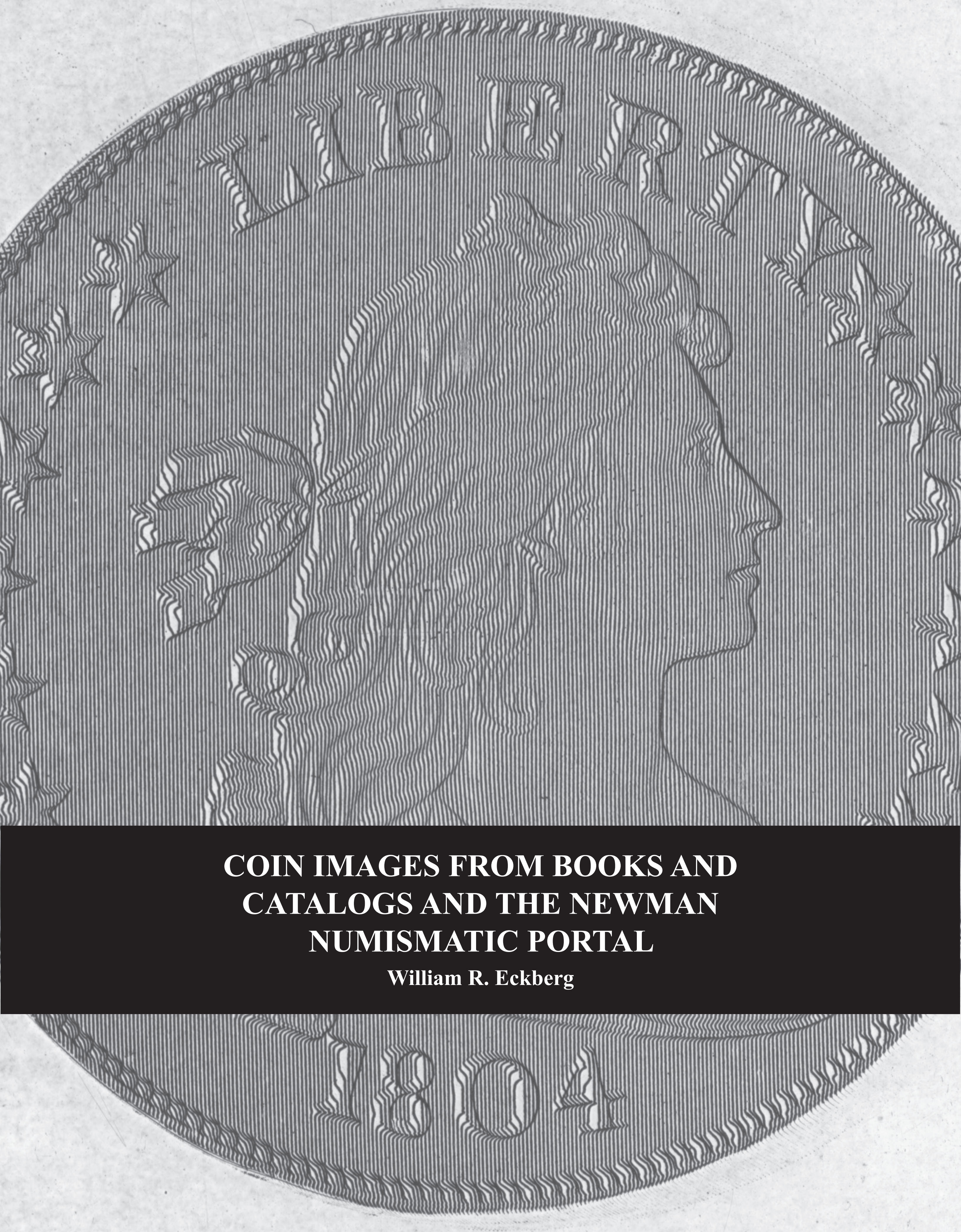

COIN IMAGES FROM BOOKS AND CATALOGS AND THE NEWMAN NUMISMATIC PORTAL

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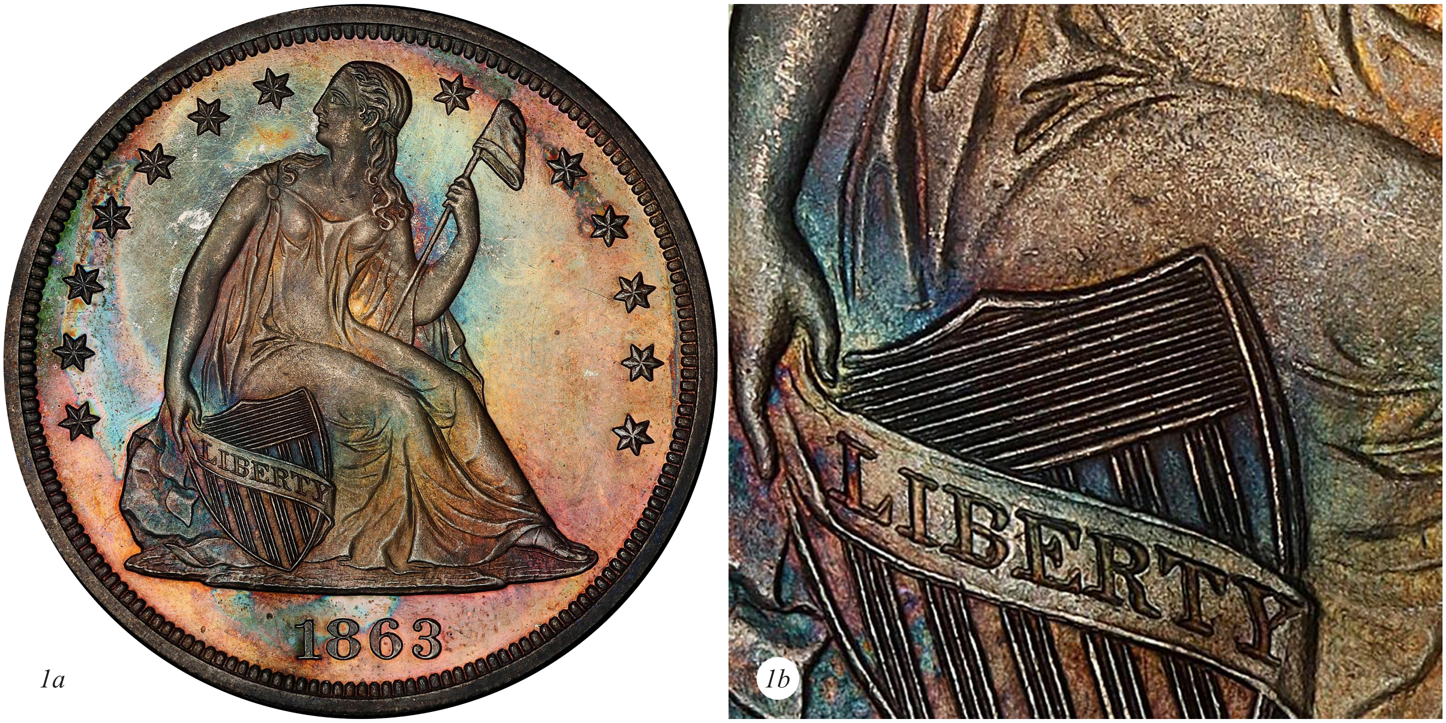
We live in a time of access to more information about coins than we would have thought possible just a few years ago. Today's auction catalogs and books feature good quality images of the coins, and the online versions of the auction catalogs feature very high-resolution images in full color. Figure 1a shows an image of an 1863 proof Seated Liberty dollar from a recent Stacks Bowers sale in stunning living color. Figure 1b shows that such images can be greatly enlarged to show even the most minute details. Note how the shield chief lines do not actually touch Columbia's thumb. She even has fingernails! Until the mid-late 2010s, digital online images, when offered at all, had limited resolution and therefore limited usefulness. Now, the online images give the collector an opportunity to make detailed study of the coin at his/her leisure.

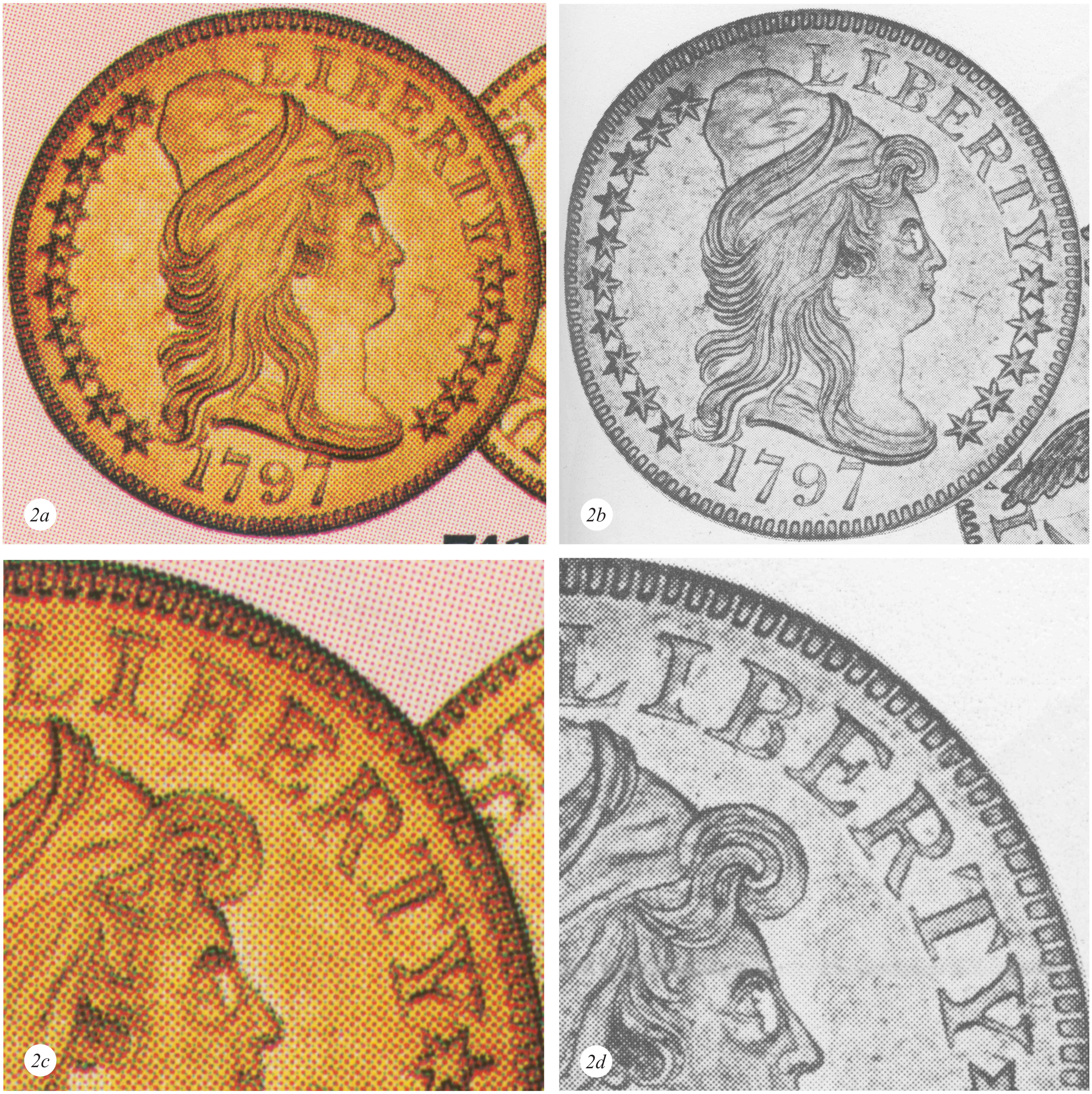
Figure 1. 1863 Proof quarter.



a, entire coin.
b, closeup of the shield and Liberty's hand showing the precise engraving. Courtesy of Stacks Bowers.

As might be expected, pre-Internet coin auction catalog images did not have the quality of current offerings. To use an example of a catalog that was state of the art for 1987, the Bowers and Merena Norweb Collection Sale Part 1 offered enlarged images of many lots and color plates of some. Figure 2a shows the color image of the 1797 15-star half eagle. The halftone dot pattern leaves a very muddy image; it would be a challenge to identify the coin from that image. Figure 2b is the enlarged black and white image from the catalog lot description. The image is far clearer, though still not remotely as clear as the image in Figure 1. Figures 2c and d show enlargements of 2a and b that make the halftone patterns clearer and so show the limitations of the halftone process for coin illustration. Note that the tresses by Liberty's ear cannot be distinguished at all in the color images.

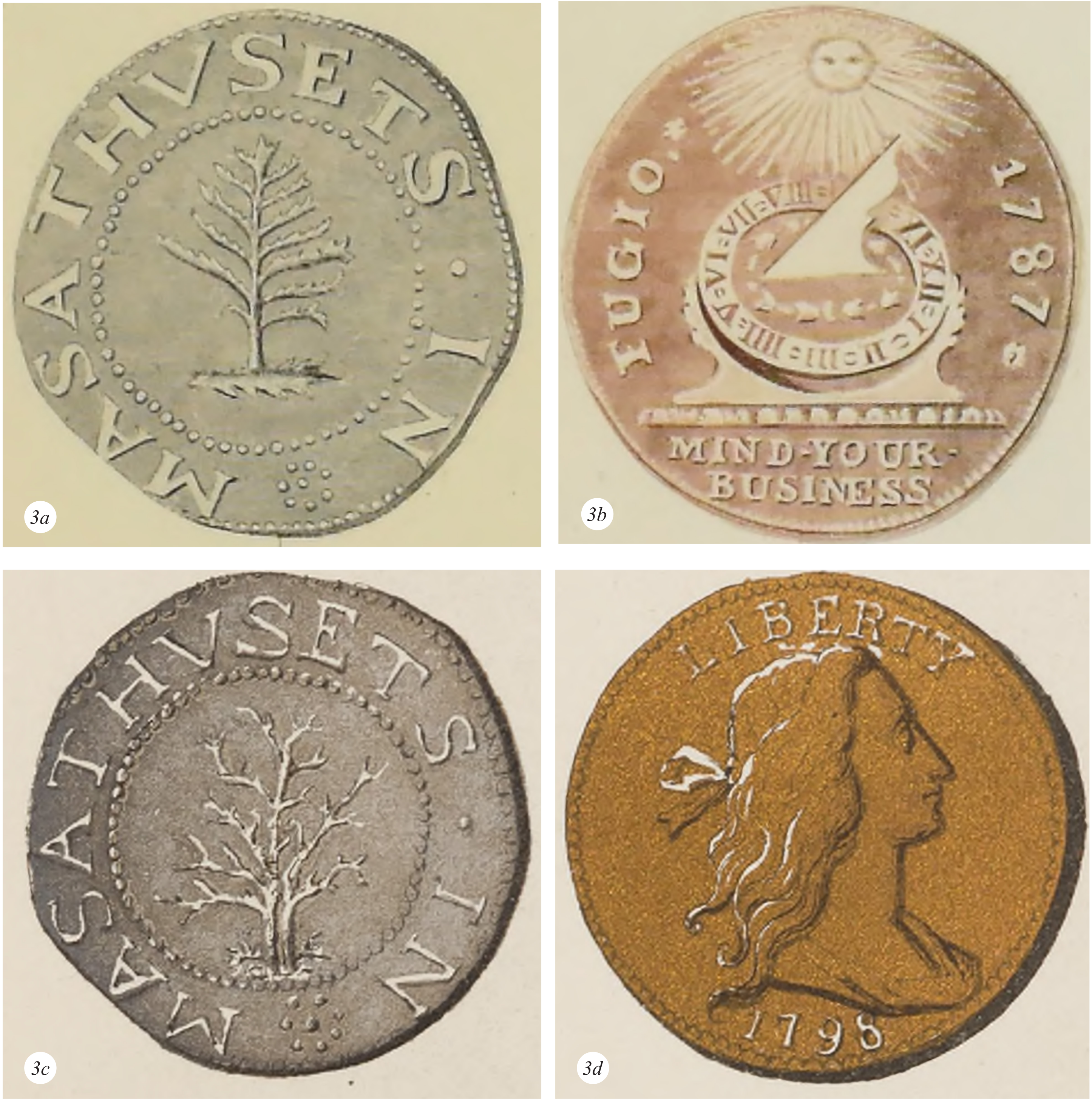
Figure 2. 1797 half eagle from the Norweb collection.



a and c, images of the color plate showing the coarse halftone screening.
b and d, the same coin from the grayscale images in the catalog. The halftone screen is far finer, giving better detailed images, but is still obvious.

Coin illustration did not begin with photography. Earlier volumes used images that were engraved or drawn as lithographs. Most such tomes focused on ancient and medieval coinages. Shortly before the Civil War, volumes that addressed United States coinages began to appear. Color lithographic images of drawings of coins from John H. Hickcox' 1858 An Historical Account of American Coinage and Montroville W. Dickeson's 1860 American Numismatic Manual give an idea of what coin images looked like before photography. Figure 3a is a Pine Tree shilling from Hickcox; Figure 3b is a Fugio cent from the same book. Figure 3c purports to be an Oak Tree shilling from Dickeson. The picture resembles an actual coin only in the most casual way. The Oak Tree appears at first to be an excellent representation of the coin, but a close look reveals that the tree does not look like that of any known variety, and the border inscription is that of a Pine Tree shilling. Figure 3d purports to be a Draped Bust cent from the same book. It dobarely resembles a Draped Bust cent. It should be obvious that, even though the images in Hickcox' book are far more realistic than those in Dickeson's, these images are artists' representations, and none are faithful renderings of any actual coin.

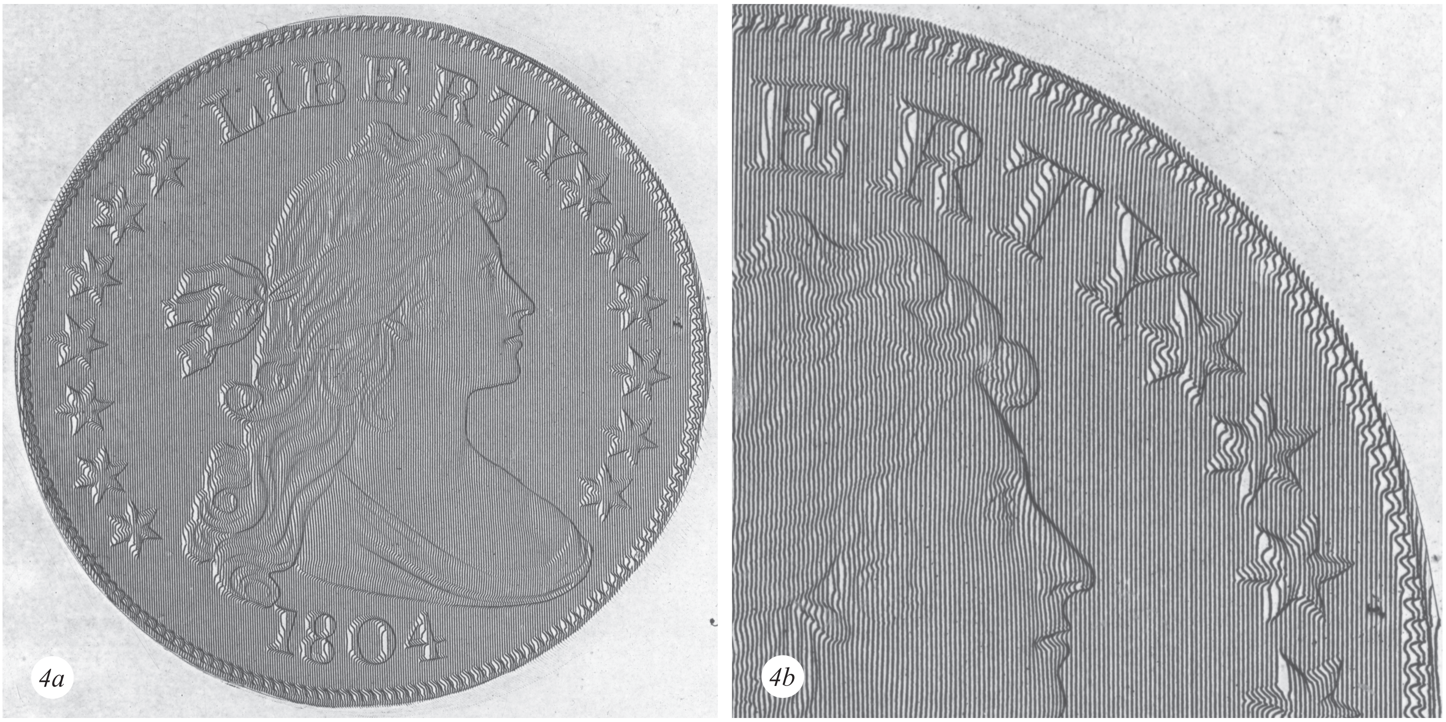
Figure 3. Drawn lithographic images from John H. Hickcox' 1858* An Historical Account of American Coinage *(a and b) and Montroville W. Dickeson's 1860* American Numismatical Manual *(c and d).



These are artists' renditions of what the generic coins look like and not facsimiles of any particular variety.

Highly realistic images of coins became available in the 1840s. Christian Gobrecht and Joseph Saxton developed a method to reproduce coin images that was used in U.S. Mint publications. The coin (usually an electrotype of it) was scanned in a medal ruling machine that Sexton perfected. It engraved an image of the coin into a plate which could then be inked and printed like any engraving. Three-dimensional surface features on the coin caused the needle to jiggle, making the engraved lines jaggy. This gave a three-dimensional look to the print. An example of the obverse of an "original" 1804 dollar from Jacob Eckfeldt and William E. Du Bois' 1842 A Manual of Gold and Silver Coins of All Nations is shown in Figure 4a. Figure 4b is an enlargement showing the engraved line patterns more clearly. Incidentally, the coin used for this image was the first report that an actual dollar dated 1804 existed! Coin images from Saxton's medal ruling machine were beautiful and of extremely high fidelity to the original.

Figure 4. Line engraving of an 1804 dollar produced by Joseph Saxton's medal ruling machine.



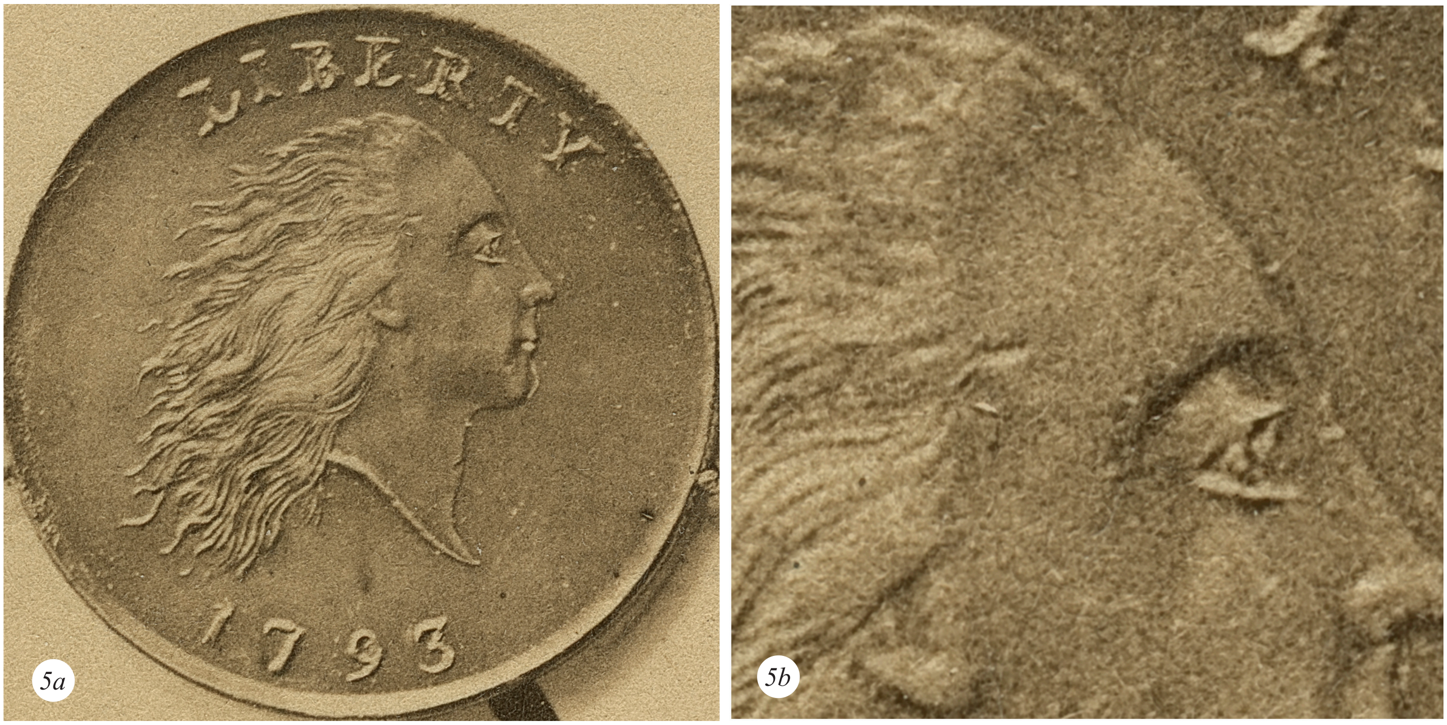
The image is composed of parallel lines that deviate when tracing a change in the coin's relief, giving a beautiful three-dimensional effect.

Photography developed (pun intended) in the 1830s-40s. Two successful approaches, the calotype and the daguerreotype, first appeared in the 1830s. Interestingly, the first photograph known to have been taken in the United States was a daguerreotype Joseph Saxton took through the window of his office in the Mint. Daguerreotype images were extremely popular but could not be reproduced and were very fragile; the image could be destroyed, or even removed from the plate completely, simply by rubbing with a finger. Daguerreotypes were, obviously, completely unsuitable for illustrating coins – or anything else – in books or catalogs. Calotypes could be printed multiple times, but the process was exceedingly slow and difficult to reproduce consistently. I am unaware of any calotype or daguerreotype images of identifiable U.S. coins.

Things changed rapidly. The middle of the nineteenth century was a time of great experimentation in photography. Collodion-silver coated glass plates created a far superior medium for making photographic negatives. The many familiar photos of Civil War battlefields were made this way. Albumen (egg white)-coated paper became commercially viable in the 1850s; when sensitized with silver nitrate and toned with gold, giving the image a brownish tint, it became the best medium for positive prints.

I believe it is critical for those of us who have access to newer technologies for the study of coins to acknowledge the impressive feats achieved by numismatists of so many generations ago. Photographs of U.S. coins have been around since J.N.T. Levick's famous plate of 1793 cents was published in 1869. At first, silver-based photographic prints of the coins from full-size negatives were used, as in the Levick plate. Figure 5a shows the Chain AMERI. obverse scanned directly from an original Levick plate at 2400 pixels per inch (PPI). Figure 5b is an enlargement of the upper face of the same coin; the dot patterns you see are the individual silver grains that make up the published image. The closer the grains are to each other, the darker the image. Silver-based direct printing gave excellent reproduction, but such images could fade over time, especially if exposed to light or if not fixed sufficiently. Fixing stabilizes the image by removing unexposed silver, thereby protecting the image.

Figure 5.

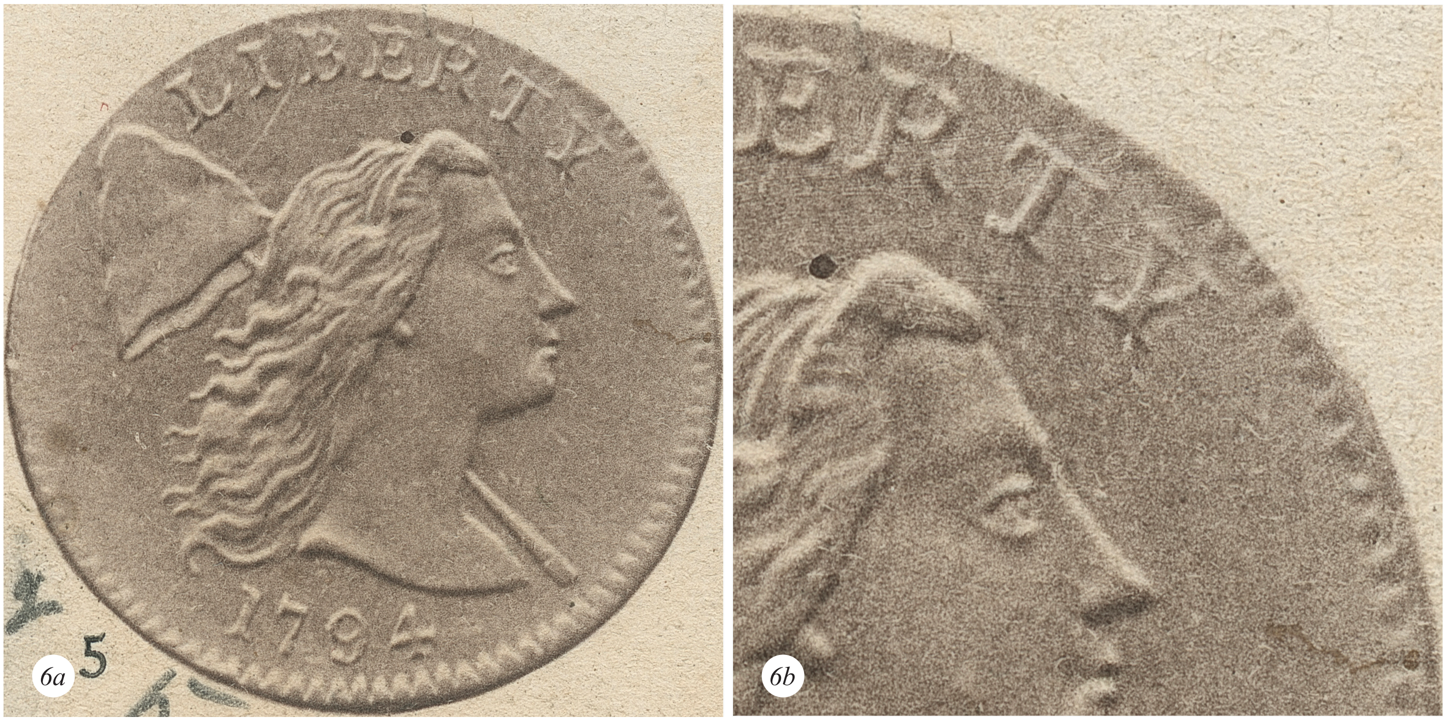


a, high-resolution scan of a 1793 Chain cent from an original copy of the Levick plate.
b, enlargement of the same image showing the random pattern of silver grains in the photograph.

Books and a few auction catalogs with photographic plates became available soon after, and many of these are prized by collectors today. Figure 5 confirms that the quality of these images was excellent, but their usefulness for study was limited by the image sizes and by the time, money and skill needed to produce and reproduce such plates. Direct contact printing and chemical development, as was done for the Levick plate, was time-consuming and depended on the skill of the printer to get consistency in each copy. Every individual copy of the plate had to be printed by hand and mounted on paper for the published article.

Excellent photographic images continued to be used throughout the 19th century, but they often used technologies different from that used in the Levick plate. The Frossard/Hayes monograph of 1893, Varieties of United States Cents of the year 1794, used photographic plates that were printed by a process called autotypy, also known as carbon printing (Figure 6a). The autotypy process gives an equally fine-grained image to silver printing and has the advantage that it will not fade over time. The image in Figure 6a was scanned at 2400 ppi like that in Figure 5; Figure 6b is an enlargement showing the carbon specks that make up the image.

Figure 6.

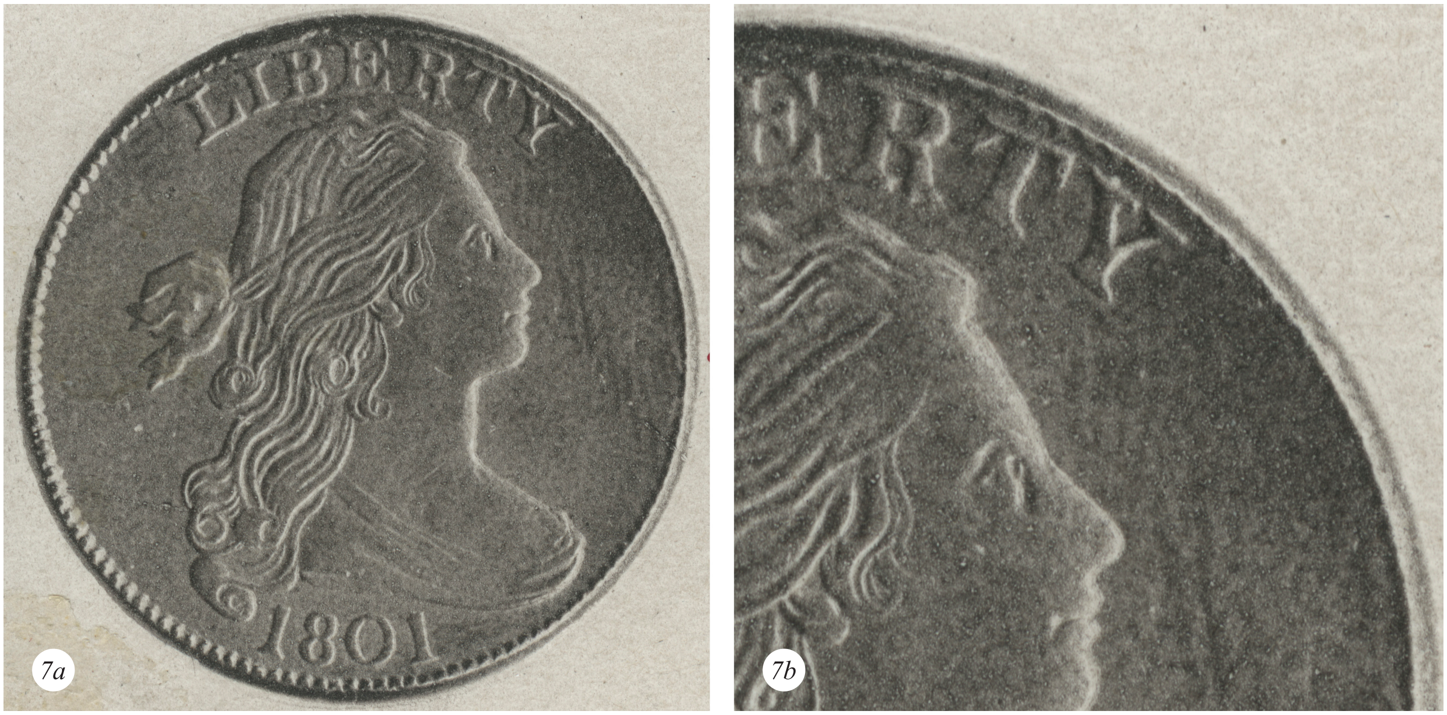


a, high resolution scan of a 1794 cent from an original copy of the Frossard/Hays monograph. This image was produced by autotypy, also called carbon printing.
b, enlargement of the same image showing the fine carbon particles that make up the print.

Unfortunately, autotypy requires just as much skill, time and effort as silver printing. Paper coated with pigmented gelatin is sensitized with potassium dichromate and when dry exposed to light with the gelatin side in contact with the negative. It is then transferred to a second sheet of gelatin-coated paper and the original backing paper peeled off. The image could then be developed with warm water, which rinses off the unexposed pigmented gelatin. Is that complicated enough for you? Would you care to print 100 identical copies of a negative that way? Could you?

Neither silver prints nor autotypes were suited for anything more than very limited numbers of prints. Photomechanical methods were developed to meet the need of larger print runs. Édouard Frossard’s 1879 Monograph of United States Cents and Half Cents and Sylvester S. Crosby’s The Early Coins of America were printed by heliotypy, a process allowing images closely mimicking direct photographic prints to be mass-produced. Images were printed on a photosensitive gelatin-covered plate that was then chemically treated so as to accept ink and then inked and printed like a traditional drawn (not halftoned) lithograph. In this process, the treated image is somewhat greasy and so accepts printers’ ink, whereas the rest of the surface of the plate is wetted with water to keep the ink from adhering where it shouldn’t. In Figure 7a, also scanned at 2400 ppi, you are not looking at silver or carbon grains, but rather ink dots. Because of this, the images are softer and more fine-grained as the enlargement in Figure 7b shows. The image is also noticeably blacker than those in Figures 5 and 6 because it is printed in black ink. However, it could have been printed in any color. Direct scans from original heliotype images are quite sharp and very attractive.

Figure 7.



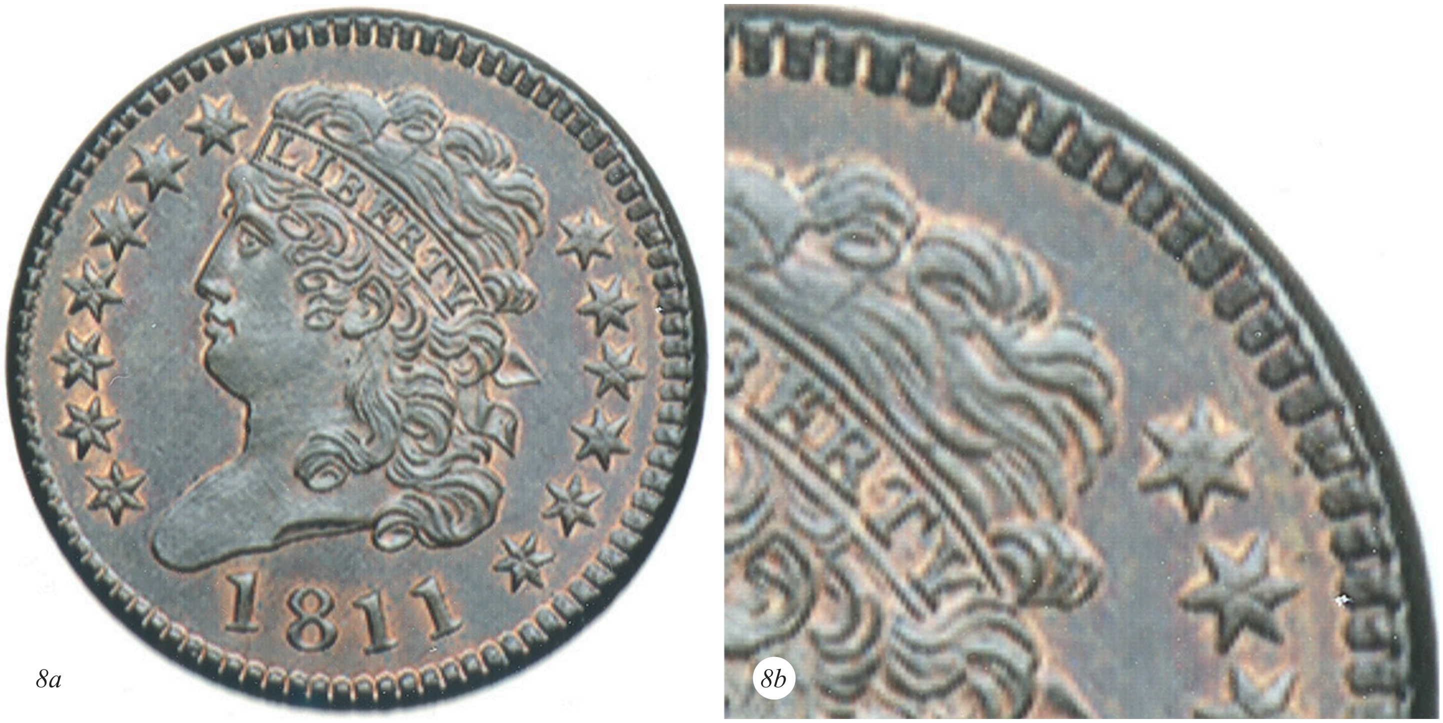
a, high resolution image of an 1801 large cent from Frossard’s 1879 monograph printed by heliotypy.
b, enlargement showing the very fine grain of the original image.

Another technology, dye sublimation (dye-sub) gives printed images from digital files. Dye-sub is a photomechanical process by which a series of colored ribbons (in this case cyan, magenta, yellow and black) are passed over plastic "paper" and exposed to intense heat. The heat vaporizes the pigment in the ribbon and deposits it on the paper. The resolution of dye-sub images is greater than that of inkjet printers, so the colored dot patterns do not appear, and the images are much more stable. The deluxe edition of the Goldbergs' 2015 Missouri Cabinet catalog contained a series of dye-sub plates featuring each coin in the sale in its actual size. Figure 8a shows a scan of a coin from a dye-sub "photographic" plate. The quality of such an image is very good, but the images are tiny – 23 mm in diameter. The enlarged image in Figure 8b shows some pixilation as the image is near the limit of the resolution of the printer.

Library copies of books and monographs with plates like these are challenging to get as the books are precious and generally do not circulate. They are also rare and costly to purchase. Fortunately, we can study these coin images even if we don't have a copy of the original publication. The generosity of the late Eric Newman in endowing the Eric P. Newman Numismatic Education Society (EPNNES) and the Newman Numismatic Portal (NNP) has allowed these rare images to be scanned and made available to everyone at no cost through the Internet.

When using images from the NNP, it is important to understand the images that are offered there, as they are generally downsampled in the interest of saving space on the servers. There are several ways of downsampling images. Those most commonly seen image formats are Portable Document Format (PDF), Tag Image File Format (TIFF or TIF), Joint Photographic Experts Group (JPEG or JPG) and Portable Network Graphics (PNG). There is a newer version of JPEG called JPEG2000 (JP2). The NNP offers PDF and JP2 formats. Some files are also available in TIFF. Frossard/Hays is available as a PDF and as two different single-page original JP2 versions. The smaller one creates a 15.4 MB folder; the larger creates a 169.9 MB folder.

Figure 8.



a, high-resolution scan of an 1811 half cent printed by dye sublimation.
b, enlargement showing the limits of the printing process.

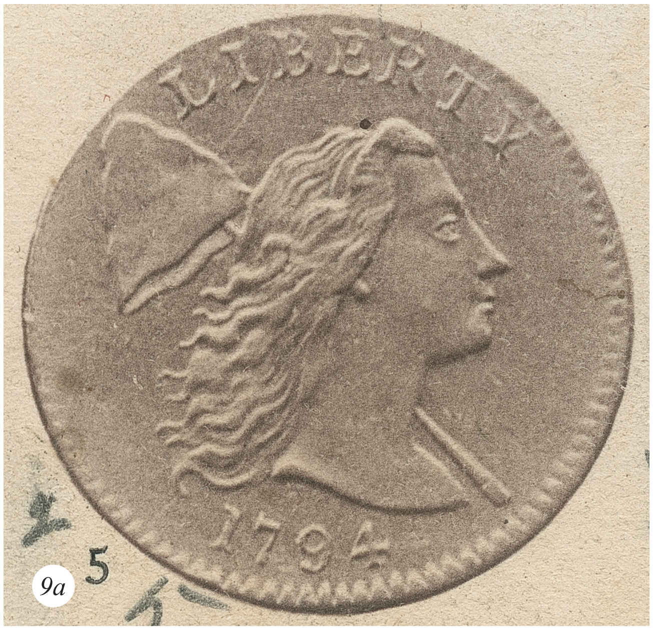
Figure 9 shows six different versions of the coin from Figure 6. Figure 9a is the same scan shown in Figure 6. Figure 9b is an image of the same coin downloaded in JP2 format from the Newman Numismatic Portal (NNP) in early December, 2023; it was the highest resolution image available from the NNP when it was scanned in 2016, but its resolution is 300 ppi, much less than the 2400 ppi of the scan in 9a. (Comparison of NNP images saved as TIFFs vs those saved as JP2s revealed no visible differences, even on magnification.) To test how much of the difference between the images is due to scan resolution, I next scanned the original plate at 300 ppi (Figure 9c). The sharpness is greater than that of the NNP image, but not nearly as great as that of the 2400 ppi scan. This tells us that the NNP image has been downsampled to save storge space.

The real surprise is Figure 9d. Most numismatists who want to download images from old books and catalogs at the NNP download them in PDF format. PDF allows the entire book or catalog to be stored at a resolution that is good for reading, but many NNP PDFs are inadequate for images. Figure 9d shows the same coin taken from the PDF version of Frossard/Hays. The image is severely degraded and of essentially no value, even for plate matching. This was a deliberate decision on the part of Internet Archive (host of the NNP) to keep the PDF files to a manageable size. When you're looking for information from the NNP, use the PDF versions for text and possibly to identify coins for further study, but use the JP2s or TIFFs for the actual coin images.

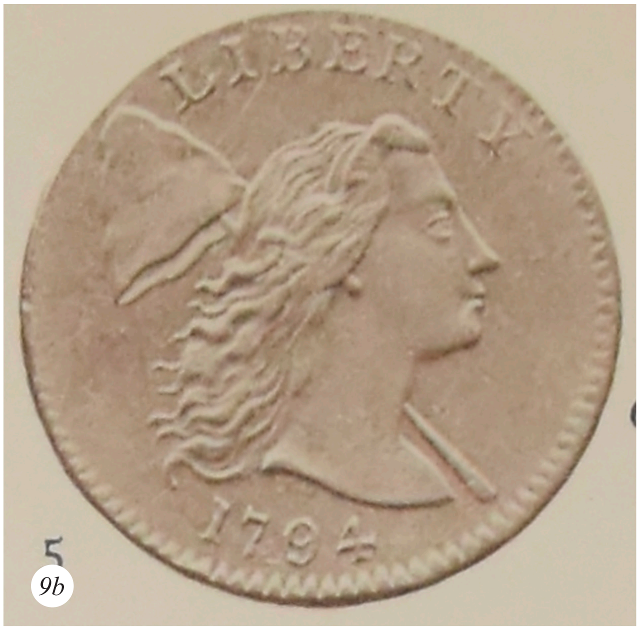
The bulk of the images on the NNP were scanned at 300 or 400 ppi. However, in recent years, the NNP has been scanning documents at higher resolution. The Frederick B. Taylor photographic plates of colonial coins (Bowers and Merena, March 1987) were scanned at 600 ppi. After consultation with Len Augsburger, I provided my copy of Frossard/Hays to the NNP for scanning at higher resolution. Figure 9e shows their scan at 600 ppi. The image is far sharper than their original image at 300 ppi. The pdf version from the new scan (figure 9f) was a great revelation; the image quality approaches that of the JP2. Evidently, they are using a different algorithm to create pdfs today.

Figure 9. Different source images of the coin shown in Figure 6.

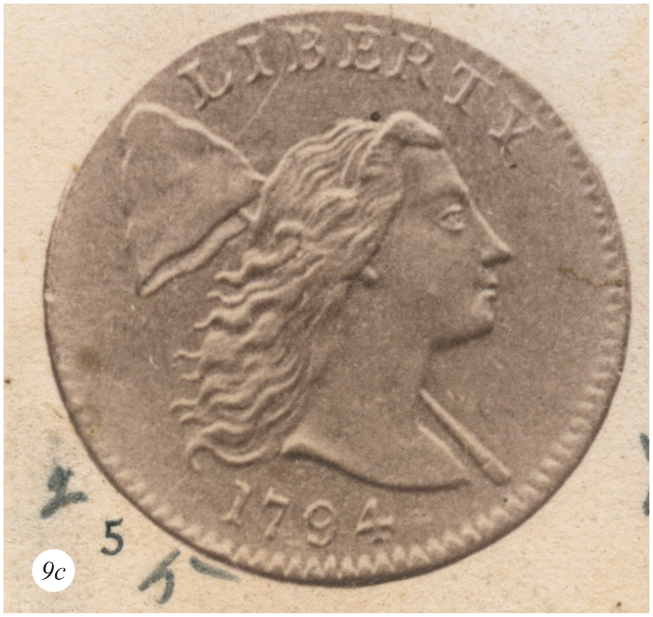
a, high resolution scan as in Figure 6.
b, 300 ppi image of the same coin from the Newman Numismatic portal.
c, original image scanned at 300 ppi.
d, image of the same coin from the PDF version of the book on the NNP.
e, new image of the same coin scanned at 600 ppi by the NNP.
f, PDF of the 600 ppi scan at the NNP.



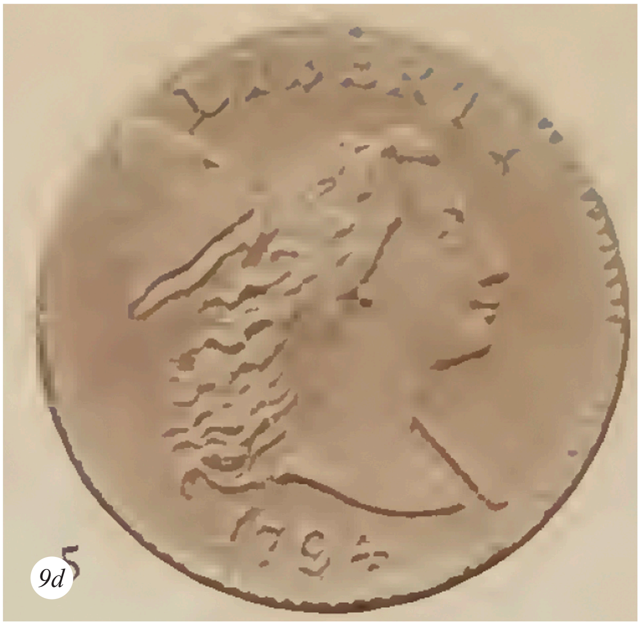
9a



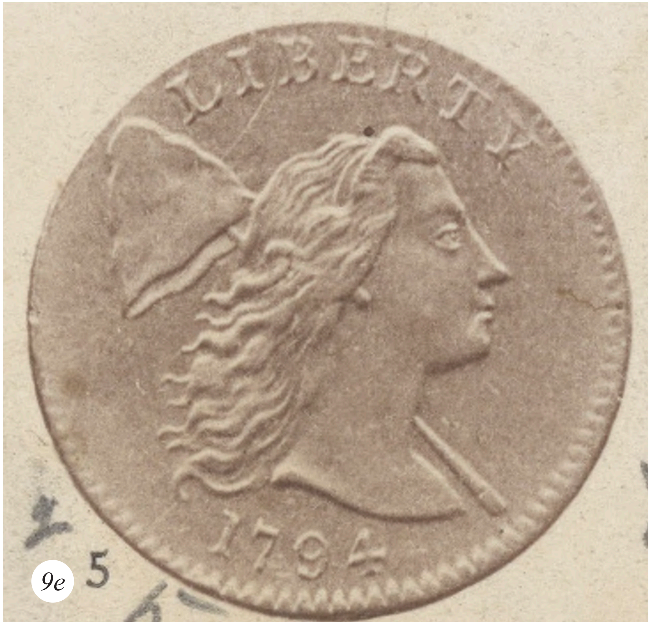
9b



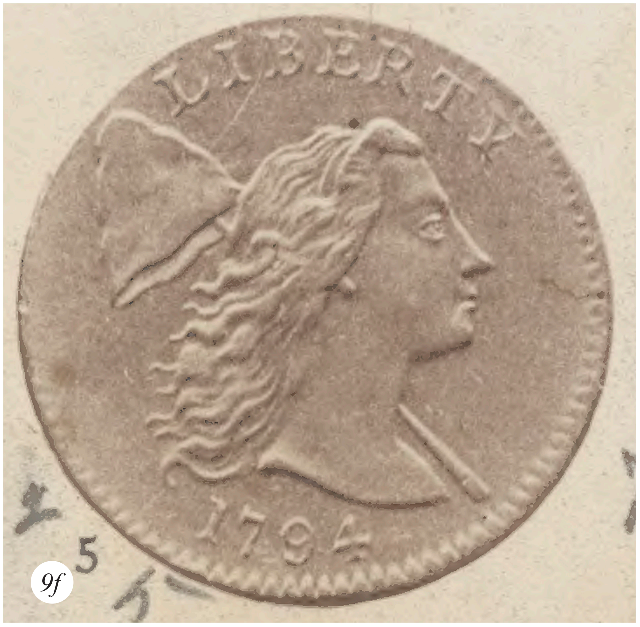
9c



9d



9e



9f

Another interesting case is the Gilbert book on half cents. Gilbert's plates are photographic silver prints, but they were produced nearly fifty years later than the Levick plate. Figure 10a is a 2400 ppi scan of 1808 obverse B from Plate III from the original printing in 1916 (thanks to Rob Kelly of the American Numismatic Association). Figure 10b is an image from the same plate downloaded as a JP2 image from the NNP. This is the best image on the NNP. It is 300 ppi, and the loss of detail is obvious and substantial. Figure 10c is a 2400 ppi scan of a photographic print from a reprint edition of the same plate. The tonal range in the original appears slightly superior to that of the reprint, but it could be adjusted digitally and made indistinguishable from the earlier printing. Otherwise, the images are of equal quality. Figure 10d is a scan of a halftone from a later, lower quality reprint edition of the book. The loss of detail in the halftone is substantial.

Two things are immediately clear when the Gilbert images are compared to those previously shown. The first is that the image is not as sharp; it is likely that the photo was not perfectly focused, or the lens through which the photo was taken had spherical aberration. The second is that there is no apparent grain pattern in the enlargement, because the film and paper had become much finer-grained by 1916.

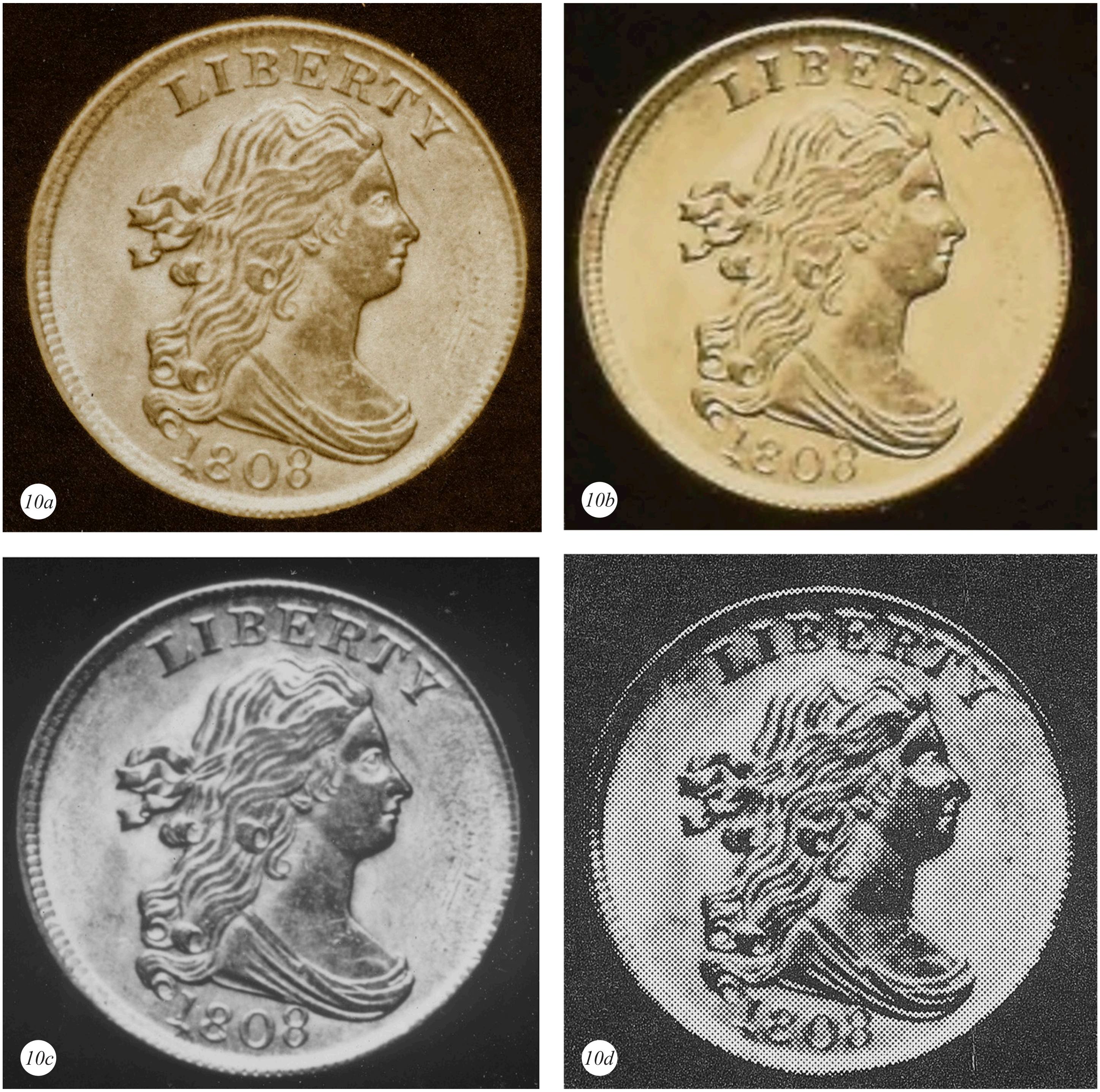
It should be obvious that the scan of the original print, even though it isn't particularly sharp, gives the superior image. The NNP image is far less sharp and has less contrast. The halftoned image shows considerable loss of detail, and descreening it (computationally removing the screen dot pattern, not shown) just blurs the image out. Descreening may be fine for images from your high school yearbook, but it is death as a means to improve the look of coin photos.

We are used to thinking that newer technologies always represent improvements on older technologies. However, this study of older publications shows very clearly that coin photographs published in the last half of the 19th century were far superior to those published in the mid-late 20th and early 21st century. This may surprise the reader who is under the impression that the latest technology always improves things.

This project also shows that serious study of images from 19th century books requires access to the original images or very high-resolution scans of them. The highest resolution scans at the NNP should be adequate for plate matching but not for detailed analysis. It has been speculated that the existence of the NNP has made antique numismatic books obsolete. This study shows that, despite the great value in having these materials available for free online, there is no substitute for the originals.

It is also worth mentioning that printed books have lasted hundreds of years with little or no degradation, but the file formats used today have been available only since the 1990s. Will they still be useful in another 500 years?

Figure 10. Images of an 1808 half cent from the Gilbert monograph.



a, high resolution scan from an original copy of the book (courtesy of Rob Kelly of the ANA).
b, scan of the same coin from the NNP.
c. high resolution scan from a reprint copy of the book with photographic plates.
d, high resolution scan of a later reprint edition with halftone images.

I wish to thank Rob Kelly of the ANA for his excellent high-resolution copying of the Gilbert and Eckfeldt-Du Bois plates and Len Augsburger and David Fanning for helpful discussions.